ALBERTA OIL SANDS INDUSTRY QUARTERLY UPDATE

FALL 2016

Reporting on the period:
June 16, 2016 to October 7, 2016

All about the oil sands

Background of an important global resource

Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada's 173 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 168 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 168 billion barrels of bitumen represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest-central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the "gum" to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

For the first time in 2012, in situ oil sands production exceeded mined oil sands production in Alberta. In 2014, 58 per cent of the province's oil sands volumes were produced using in situ methods. Alberta will continue to rely to a greater extent on in situ production in the future, as 80 per cent of the province's proven bitumen reserves are too deep under ground to recover using mining methods.

There are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and the melted bitumen flows into the lower well via gravity and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The selection is based on a number of factors, including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or "upgraded," can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil, which is a refinery feedstock. That can be transformed into transportation fuels and other products. ■

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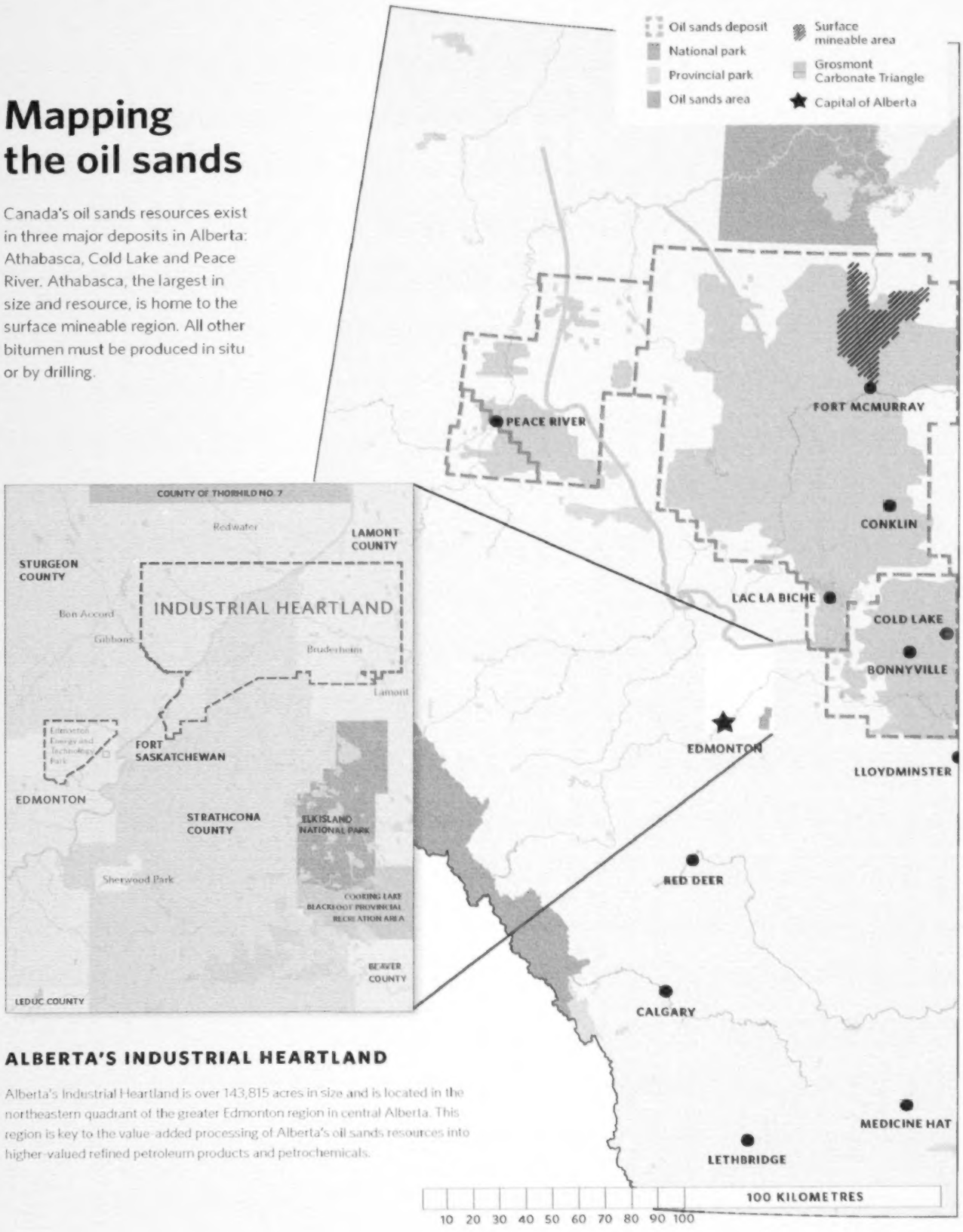
Mapping the oil sands

Canada's oil sands resources exist in three major deposits in Alberta: Athabasca, Cold Lake and Peace River. Athabasca, the largest in size and resource, is home to the surface mineable region. All other bitumen must be produced in situ or by drilling.



ALBERTA'S INDUSTRIAL HEARTLAND

Alberta's Industrial Heartland is over 143,815 acres in size and is located in the northeastern quadrant of the greater Edmonton region in central Alberta. This region is key to the value-added processing of Alberta's oil sands resources into higher-valued refined petroleum products and petrochemicals.

GOVERNMENT UPDATE | Alberta Government

THREE NEW OIL SANDS DEVELOPMENTS RECEIVE INITIAL APPROVAL FOLLOWING REGULATOR REVIEW

Three new proposed oil sands developments have cleared an important early step in the regulatory process.

Government has approved the proposals for:

- The Blackpearl Resources Blackrod oil sands SAGD development;
- The Surmont Energy Wildwood oil sands SAGD development; and
- The Husky Saleski oil sands development.

Collectively, these projects represent about $4 billion of potential investment into Alberta's economy and about 95,000 bbls/d of production. The proposed developments will also fall under the new oil sands 100 megatonne greenhouse gas (GHG) emissions limit announced with Alberta's Climate Leadership Plan. Combined, these proposals equal about 2.5 megatonnes of GHG emissions.

The limit is an incentive for innovation, encouraging lower carbon production, more efficient projects and cost-effective emissions reduction strategies.

The approval of these proposals follows a thorough review by the Alberta Energy Regulator and its recommendation to government to approve each proposal. Those reviews included multiple environmental assessments.

"Our government supports a growing and sustainable energy sector. Along with new pipelines, regulatory certainty is crucial to continued investment into our economy and I am proud to say we are advancing this certainty," says Margaret McCuaig-Boyd, Minister of Energy.

Shannon Phillips, Minister of Environment and Parks, adds, "The emissions limit is the first of its kind set by an energy-producing jurisdiction. It positions Alberta as an environmental leader while allowing room for development. The limit was developed with industry leaders and we know they can rise to the challenge to innovate and work within the limit."

The Government of Alberta's Oil Sands Advisory Group, made up of expert advisers with environmental, industry and indigenous community perspectives, will make recommendations to government on how to implement the 100-megatonne limit for both existing and new projects.

The Blackrod oil sands project is located about 200 kilometres southwest of Fort McMurray; the Wildwood project is 65 kilometres south of Fort McMurray; and the Saleski project is 100 kilometres to the west of Fort McMurray.

Final investment decisions on the projects are at the discretion of the companies.

MEMBERS OF OIL SANDS ADVISORY GROUP NAMED

Former Canadian Association of Petroleum Producers (CAPP) President David Collyer will join environmentalist Tzeporah Berman and First Nations leader Melody Lepine in co-chairing the province's new Oil Sands Advisory Group (OSAG).

The OSAG is tasked with advising the provincial government on the oil sands aspects of its Climate Leadership Plan. The OSAG will report on how to implement the legislated annual greenhouse gas (GHG) emission limit of 100 megatonnes for oil sands

production, provide advice on innovation investments to reduce GHG emissions in oil sands production, and help identify how to develop effective structures and processes to address environmental issues such as water and biodiversity.

In addition to his role at CAPP, Collyer is also the former Country Chair of Shell Canada. Lepine is Director of Government and Industry Relations for the Mikisew Cree First Nation, and Berman is adjunct professor of the Faculty of Environmental Studies at York University.

"It is the diversity of this group and its problem-solving focus on emissions leadership, local environmental performance and innovation that will help de-escalate conflict and contribute to the ongoing success of this important industry," says Collyer.

The OSAG members will work to ensure a full range of views in their discussions, from both industry and the public. A public engagement plan is currently being developed.

"The advisory group will help our government address central issues on this key Alberta job creator and economic driver: how to establish and sustain Alberta's climate leadership among energy-producing jurisdictions; how to better steward our air, land and water; and how to take advantage of current and future market opportunities while meeting the needs of indigenous and non-indigenous communities," says Minister of Energy Shannon Phillips.

The government expects the advisory group will deliver its first recommendations in six months.

WOOD BUFFALO RECEIVING $87.5 MILLION IN AID

The Regional Municipality of Wood Buffalo is receiving $87.5 million in aid from the Alberta government to help with the uninsurable costs of the May 2016 wildfire. Such costs include emergency response, evacuation, repairs and cleanup of public areas damaged by the wildfire.

The municipality estimates its response costs to be about $175 million. This $87.5-million advance in the Disaster Recovery Program funding will cover about half of those costs.

Minister of Municipal Affairs Danielle Larivee reiterates the government's promise to support the residents of the Wood Buffalo area: "This advance on disaster recovery funds is part of that promise and will ensure the municipality can keep moving forward to clean up and rebuild, without having to carry a heavy financial burden." ■

LABOUR MARKET UPDATE

NEW DRILLING JOBS EXPECTED TO RESULT FROM NEW PROGRAM

Drilling investment and jobs will increase in Alberta through the rest of 2016 now that drilling has started on the first wells under the Modernized Royalty Framework.

Government has received dozens of drilling applications since companies were allowed to apply for early access to the new framework. Thirty-five new wells had been been approved as of Aug. 15. The Canadian Association of Oilwell Drilling Contractors estimates that each drilling rig in operation creates roughly 135 direct and indirect jobs.

Encana is the first company to have its wells approved after demonstrating increased drilling activity beyond what was anticipated for 2016. Those new wells began operation in the Duvernay-Montney basin near Grande Prairie.

This increased activity is a direct result of government's decision to allow the early adoption of the Modernized Royalty Framework for wells that otherwise would not have been drilled this year.

"Our new royalty framework is good news for all Albertans. It's putting more rigs out in the field, creating jobs and increasing revenue for our province. We are pleased to see so many applications to drill come in and are encouraged that companies want to accelerate their capital investments – this is exactly what a modern, competitive and responsible royalty framework should do," says Margaret McCuaig-Boyd, Minister of Energy.

Richard Dunn, Encana's Vice-President of Government Relations, says the modernized royalty framework provides certainty and clarity for the industry.

"As a result of the government's flexibility in allowing for early opt-in to the modernized framework, we have added to our development plans in Alberta this year, a time when investment in our industry is exceptionally important to local economies," Dunn says.

The Modernized Royalty Framework will go into effect Jan. 1, 2017.

UNEMPLOYMENT RATE EXPECTED TO REMAIN ELEVATED

According to the Government of Alberta's first quarter fiscal update released Aug. 23, employment in 2016 is expected to fall by 1.7 per cent, in line with the budget forecast.

Over the last 12 months, the impact of the employment reductions have been most pronounced in the goods-producing sector, where employment has fallen by a total of 82,300 jobs since July 2015. These losses were partially offset by gains in the services-producing sector, which grew by 33,200 jobs since July 2015. A slightly larger lift in employment of 1.2 per cent in 2017 is now forecast due to reconstruction efforts.

After averaging 7.6 per cent in the first six months of 2016, Alberta's unemployment rate jumped to 8.5 per cent in September. The unemployment rate is expected to remain elevated over the last half of 2016 and average eight per cent for the year.

JOB GRANT HELPS EMPLOYERS GET BETTER TRAINED WORKERS

Employers are seeing the benefits of the Canada-Alberta Job Grant (CAJG) that is helping businesses gain and retain workers with the right skills.

Launched in October 2014, the CAJG responds to Alberta's labour challenges by helping employers build a skilled workforce to meet current and future needs. The program is delivered by the provincial government with joint funding from the Government of Canada and employers.

"Investing in training and continuous learning leads to more career opportunities and greater chances at career advancement. The [CAJG] is one way we are supporting employers to make training decisions that are best for their business," says Christina Gray, Alberta Minister of Labour.

As of June 2016, more than $29 million had been approved for training. More than 5,700 applications have been approved for more than 2,400 unique employers in Alberta.

More than 11,000 training courses have been approved for a variety of training programs such as project management, risk management, health and safety courses, leadership skills and driver training.

The program lets employers decide who gets trained and what type of training their current or prospective employee should receive. For employers who are training potential workers, it's expected the individual will be hired upon completion of training. ■

WHAT'S NEW IN THE OIL SANDS

BUSINESS

Alberta's chief energy economist says that breakeven thresholds for oil sands projects are about $10/bbl lower today than they were two years ago. However, costs are not expected to drop much further. "On average, the cost to construct new facilities has fallen eight to 10 per cent compared to 2014, whereas the weighted average operating costs for mines has fallen by 25 per cent and the thermal in situ projects have fallen nearly 40 per cent," says Matthew Foss.

"We're seeing projects that we thought were $60-$70 breakevens falling back into the $50-$60 breakeven range, and hopefully most of that is permanent."

However, Foss adds, "Although costs have declined, they are expected to bottom out this year, leaving project economics challenged as prices stay and linger slightly below $50/bbl right now."

Fort McKay First Nation and Suncor Energy have signed a new $350-million deal where Fort McKay will acquire 34.4 per cent interest in Suncor's East Tank Farm by paying 34.3 per cent of the project's capital cost.

Suncor's East Tank Farm, which will support the 190,000-bbl/d Fort Hills mining project, is currently under construction and is expected to be operational in the second quarter of 2017.

Canadian Natural Resources has completed the Phase 2B expansion of its Horizon oil sands project. The company says the resulting capital spending drop will allow it to make strategic purchases.

Phase 2B will add 45,000 bbls/d of synthetic crude oil capacity to Horizon, with full production targeted for November 2016.

Teck reports that the Fort Hills oil sands project has surpassed 60 per cent despite a four-week suspension due to the Fort McMurray wildfires.

First oil is expected by late 2017; however, Teck says achievement of cost and schedule targets will depend on many factors such as timely material delivery and good labour productivity during peak construction.

Gibson Energy says it will construct two new 400,000-barrel crude oil storage tanks and related pipeline infrastructure at its Edmonton terminal due to the support of a large, investment-grade customer. This, along with Gibson's other projects, brings the company's total storage capacity to 1.7 million barrels and increases pipeline interconnectivity with Gibson's Edmonton Terminal. The new tanks are expected to be in service by the second quarter of 2018.

In August, junior Athabasca Oil Corporation received the third and final payment from China-backed Brion Energy for its interest in the Dover SAGD project.

The $1.32-billion deal originally closed in summer 2014. The first 50,000-bbl/d phase at Dover has regulatory approval, but Brion has said that it is on hold.

In August, midstream operator Inter Pipeline announced the purchase of Williams Energy's Canadian NGL business for $1.35-billion. The transaction gives Inter Pipeline ownership of two bitumen upgrader off-gas plants north of Fort McMurray, a value-adding fractionator near Edmonton and the pipeline that connects the assets.

Inter Pipeline also assumes responsibility for the potential construction of a $1.85-billion propane dehydrogenation facility located near the fractionator.

Cenovus Energy says it might soon restart construction at the Phase G expansion of its Christina Lake SAGD project, which was put on hold after oil prices dropped in late 2014/early 2015.

Cenovus is spending a small amount of capital to complete detailed engineering on Christina Lake Phase G and is in the process of rebidding work on the project, the company says.

WHAT'S NEW IN THE OIL SANDS

TECHNOLOGY

■ The federal government has given both the University of Calgary and the University of Alberta $75-million research grants over seven years to develop lower- or zero-carbon fossil fuel–based energy systems and lower the carbon footprint of existing oil and gas supply chains.

"We need to transform the ways we get energy out of unconventional energy sources such as the oil sands, so that we can meet the near-term demand for petroleum, but with a much smaller environmental footprint," says Steven Bryant, Canada excellence research chair in materials engineering for unconventional oil reservoirs with the University of Calgary's Schulich School of Engineering.

"At the same time, we need to transform how we capture, store and convert CO_2—and ultimately go beyond managing CO_2 to extract carbon-free energy from petroleum reservoirs—so that we can meet our long-term climate commitments at much lower cost."

The University of Calgary is currently examining nanoparticle-enabled processes that will lead to more energy production from a smaller carbon footprint; leveraging living microbial communities as allies for eliminating CO_2 emissions and finding new pathways for energy conversion; and "leveraging new imaging techniques to see the smallest picture at the nano-scale and the biggest picture in the sub-surface so that laboratory discoveries translate to much less environmental impact in the real world," said the university in a statement.

■ The latest performance update for Suncor Energy's Firebag SAGD project says that downhole flow control devices (FCDs), which have become more commonly used in recent years to promote uniform steam distribution and pump longevity, have a significant flaw: they're made for conventional, not SAGD wells.

In Suncor's presentation to the Alberta Energy Regulator, production engineer Jeremy D'Mello said that FCDs can help improve steam conformance when hotspots develop in a wellbore due to operating practices or heterogeneous geology. However, "vendors are supplying FCDs developed for conventional wells. A purpose-built SAGD device could be a game changer if it blocked steam better."

■ In August 2016, Nsolv Corporation announced its solvent-based extraction technology at its Fort McKay pilot project had produced over 10,000 barrels of partially upgraded, transportable heavy oil.

The company achieved this despite shutting down operations for six weeks due to the Alberta wildfires. Joe Kuhach, chief executive officer of Nsolv, attributes the company's ability to bring the pilot back online quickly to the technology's resilience compared to other production methods.

Nsolv's technology uses no water and reduces greenhouse gas emissions by about 75 per cent compared to existing extraction methods, the company says. The process is designed to use little natural gas to heat the solvent and leave many of the heavy contaminants behind within the reservoir. Because the oil is partially upgraded, Nsolv says less diluent is needed for shipping to market.

■ AMSEnergy and Heat Matrix Group are the initial winners of the Canada's Oil Sands Innovation Alliance and Foresight Cleantech Accelerator Centre challenge, which seeks to identify cleantech solutions for capturing heat lost during SAGD production.

The two winners announced this August will receive funding to develop their solutions over the next six months, as well as in-kind contributions such as laboratory space, marketing support, equipment, materials and mentoring.

AMSEnergy is developing a thermosyphon heat pipe technology and Heat Matrix uses a technology called LUVO, which incorporates polymer material.

Following this stage of the challenge, one company will be selected to receive additional funding and invited to field test its technology in western Canada. The winner will be announced in early 2017.

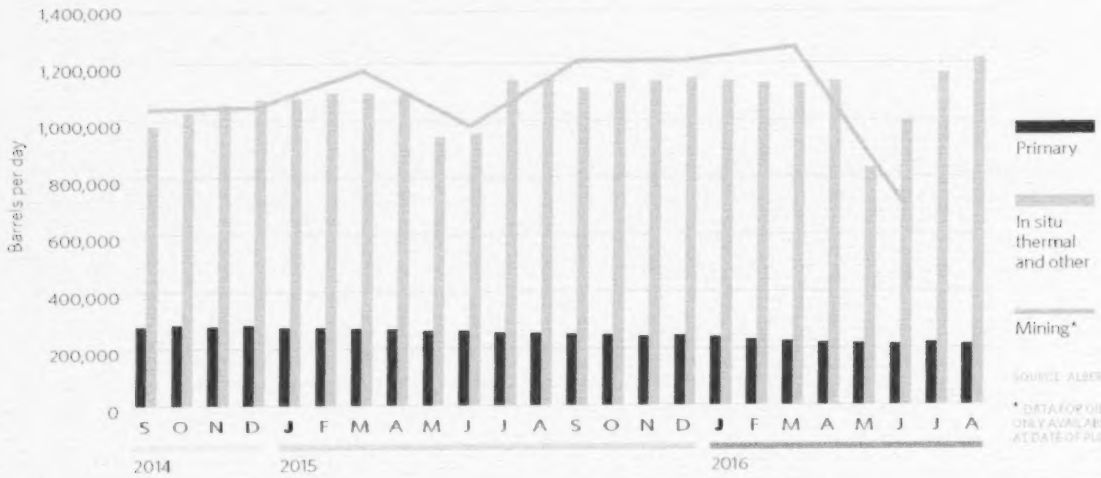
■ Environmental consultant ClimateCHECK has determined that Fractal Systems' Enhanced JetShear could reduce thermal oil diluent requirements by more than half.

The technology heats diluted bitumen just below thermal cracking temperatures and pumps it through proprietary jet-nozzles where cavitation and mechanical shearing occurs.

Between April 2014 and April 2015, Fractal says it processed over 100,000 barrels of diluted bitumen, successfully proving the base technology. ■

OIL SANDS PRODUCTION DATA

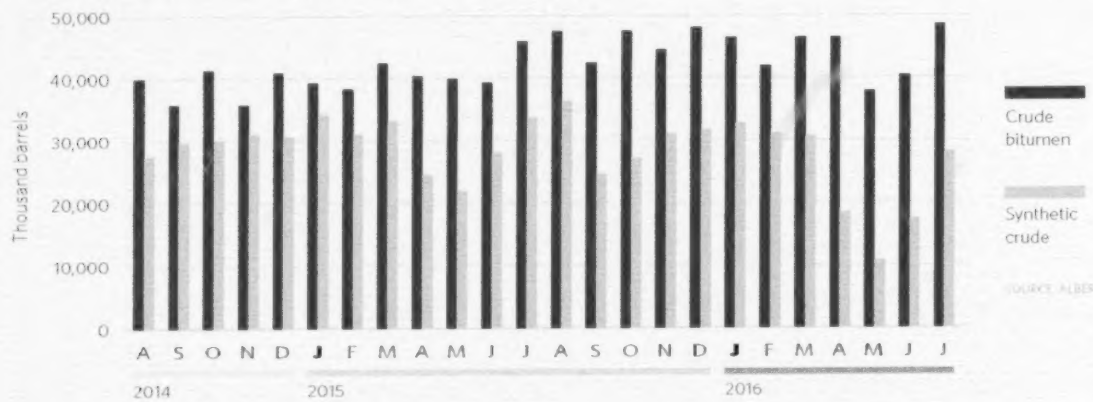
Alberta oil sands production by extraction method



SOURCE: ALBERTA ENERGY REGULATOR

* DATA FOR OIL SANDS MINING ONLY AVAILABLE TO JUNE 2015 AT DATE OF PUBLISH

Alberta crude bitumen and synthetic crude production



SOURCE: ALBERTA ENERGY REGULATOR

OIL SANDS TECHNOLOGY LEGEND *See oil sands project status listing on page 10.*

ADC (Upgrading) Accelerated decontamination

AIRINJ Air injection

C & SC Cyclic and solvent cyclic

CCC (Upgrading) Cold catalytic cracking

C-SAGD Cyclic steam assisted gravity drainage

CSS Cyclic steam stimulation

ESEIEH Enhanced solvent extraction incorporating elecromagnetic heating

ET-DSP Electro-thermal dynamic stripping

HCSS Horizontal cyclic steam stimulation

HTL Heavy-to-light upgrading process

In situ Production technology undisclosed; will use drilling and enhanced recovery

LP-SAGD Low-pressure steam assisted gravity drainage

Mining Truck and shovel mining

Nsolv purified condensing solvent extraction technology

Steam & CO_2 Steam & CO_2 Co-gen Co-injection

Orcrude Primary upgrading process

SAGD Steam assisted gravity drainage

SAP Solvent aided process

SC-SAGD Solvent cyclic steam assisted gravity drainage

TAGD Thermal assisted gravity drainage

THAI Toe to heel air injection

UPG Bitumen upgrading

USP (Upgrading) Ultra-selective pyrolysis

VSD Vertical steam drive

PROJECT LISTINGS

Project and technology legend on page 9

Updated status of oil sands projects in Alberta | As of October 2016

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABASCA REGION — MINING				
Canadian Natural Resources				
Horizon				
Horizon Phase 2B started up in October 2016 and will add 45,000 bbls/d of production. Phase 3 is currently 83 per cent complete and is on schedule and budget with start-up in Q4 2017.				
Phase 1	135,000	2008	Operating	Mining
Reliability - Tranche 2	5,000	2014	Operating	Mining
Phase 2A	12,000	2014	Operating	Mining
Phase 2B	45,000	2016	Operating	Mining
Phase 3	80,000	2017	Construction	Mining
Imperial Oil				
Kearl				
Imperial says that Kearl bitumen production averaged 165,000 bbls/d in Q1. The increase was largely due to continued strong performance from the expansion project and optimization efforts at the combined Kearl operation.				
Phase 1	110,000	2013	Operating	Mining
Phase 2	110,000	2015	Operating	Mining
Phase 3	80,000	TBD	On Hold	Mining
Phase 4 Debottleneck	45,000	TBD	On Hold	Mining
Shell Albian Sands				
Jackpine				
Phase 1A	100,000	2010	Operating	Mining
Phase 1B	100,000	TBD	Approved	Mining
Expansion	100,000	TBD	Approved	Mining
Muskeg River				
Project partner Marathon Oil says that record production of approximately 285,000 bbls/d during Q3 was largely due to improved operational reliability and no planned maintenance.				
Commercial	155,000	2002	Operating	Mining
Expansion & Debottlenecking	115,000	TBD	Approved	Mining
Pierre River				
Shell has withdrawn its application for the Pierre River project, saying it wants to focus on its existing oil sands operations. The company says it will continue to hold the Pierre River leases and may re-apply in the future.				
Phase 1	100,000	TBD	Cancelled	Mining
Phase 2	100,000	TBD	Cancelled	Mining
Suncor Energy				
Base Operations				
Suncor says that planned upgrader maintenance was completed in Q4 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
Millennium Mine	294,000	1967	Operating	Mining
Steepbank Debottleneck Phase 3	4,000	2007	Operating	Mining
Millennium Debottlenecking	23,000	2008	Operating	Mining
North Steepbank Extension	180,000	2012	Operating	Mining
Fort Hills				
Teck Resources reports that construction is more than 60 per cent complete at the end of Q2 2016.				
Phase 1	160,000	2017	Construction	Mining
Debottleneck	20,000	TBD	Approved	Mining
Voyageur South				
Suncor considers Voyageur South to be a longer-term project and has not confirmed a start-up date.				
Phase 1	250,000	2024	Announced	Mining
Syncrude Canada				
Mildred Lake/Aurora				
In December 2015, Syncrude performed coker maintenance originally scheduled for mid-2016. Suncor has closed the purchasing of Murphy Oil's five per cent stake in Syncrude and now owns 53.74 per cent of Syncrude. On Feb. 12, 2016, the company submitted supplemental information to the AER for the mine extension project, which is under review.				
Base Mine Stage 1 & 2 Expansion	290,700	1978	Operating	Mining
Stage 3 Expansion	116,300	2006	Operating	Mining
Centrifuge Tailings Management	TBD	TBD	Operating	Mining
Aurora SouthTrain 1	100,000	TBD	Approved	Mining
Aurora SouthTrain 2	100,000	TBD	Approved	Mining
Mildred Lake Mine Extension (MLX)	184,000	2023	Application	Mining
Teck Resources				
Frontier				
Teck has filed a project update for the Frontier mining development. The capital cost has been increased to $20.6 billion, and the total capacity is 260,000 bbls/d. The regulatory review process is expected to continue through 2016, making 2017 the earliest a decision report is expected. Alberta's environmental impact assessment director says that Teck's EIA report for the Frontier project has been deemed complete.				
Phase 1a	86,000	2026	Application	Mining
Phase 1b	86,000	2027	Application	Mining
Phase 2	90,000	2037	Application	Mining
Total E&P Canada				
Joslyn North Mine				
Total has withdrawn the regulatory applications for the Joslyn North Mine.				
Phase 1	100,000	TBD	On Hold	Mining
NORTH ATHABASCA REGION — IN SITU				
Athabasca Oil				
Birch				
Athabasca lists Birch as one of its long term assets.				
Phase 1	12,000	TBD	Announced	SAGD
Dover West Carbonates (Leduc)				
Athabasca lists Dover West as one of its long term assets.				
Phase 1 Demonstration	6,000	TBD	Approved	SAGD
Phase 2 Demonstration	6,000	TBD	Application	SAGD
Dover West Sands & Clastics				
Athabasca has been assessing the development timeline of the Dover West Sands Project. Given that the change in global commodity prices has affected the ability to finance projects in the near term, the considerable uncertainty in regulatory and royalty regimes, and the present shift in focus to Athabasca's Hangingstone asset area in the immediate future, a decision regarding the regulatory application has not yet been taken, but it is likely that management will advance the regulatory application during 2016.				
Phase 1	12,000	TBD	Application	SAGD
Phase 2	35,000	2019	Announced	SAGD
Phase 3	35,000	2020	Announced	SAGD
Phase 4	35,000	2022	Announced	SAGD
Phase 5	35,000	2024	Announced	SAGD
BP				
Terre de Grace				
BP stated in late 2014 that it is unlikely Terre de Grace would come online before 2020.				
Pilot	10,000	TBD	Approved	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Brion Energy				
Dover				
Brion Energy says that the Dover project is on hold.				
Dover Experimental Pilot	2,000	2017	Approved	SAGD
Dover North Phase 1	50,000	TBD	On Hold	SAGD
Dover North Phase 2	50,000	TBD	Approved	SAGD
Dover South Phase 3	50,000	2021	Approved	SAGD
Dover South Phase 4	50,000	2023	Approved	SAGD
Dover South Phase 5	50,000	2025	Approved	SAGD
Mackay River				
Brion revealed at the 2016 CAPP investment symposium in Toronto that construction is mechanically complete. Steaming will start this summer with first oil expected late 2016 or early 2017.				
Phase 1	35,000	2017	Construction	SAGD
Phase 2	40,000	TBD	Approved	SAGD
Phase 3	40,000	2020	Approved	SAGD
Phase 4	35,000	2022	Approved	SAGD
Canadian Natural Resources				
Birch Mountain				
Phase 1	60,000	TBD	Announced	SAGD
Phase 2	60,000	TBD	Announced	SAGD
Cenovus Energy				
East McMurray				
Phase 1	30,000	TBD	Announced	SAGD
Steepbank				
Phase 1	30,000	TBD	Announced	SAGD
Telephone Lake				
Cenovus says it continues to review development options for Telephone Lake after receiving regulatory approval in late 2014.				
Phase A	45,000	TBD	On Hold	SAGD
Phase B	45,000	TBD	Approved	SAGD
E-T Energy				
Poplar Creek				
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	1,000	2012	Suspended	ET-DSP
Grizzly Oil Sands				
Thickwood				
This project application has been withdrawn and closed by the AER.				
Phase 1	6,000	TBD	Cancelled	CSS & SAGD
Phase 2	6,000	TBD	Cancelled	CSS & SAGD
Husky Energy				
Saleski				
Husky has received approval from the AER.				
Carbonate Pilot	3,000	TBD	Approved	CSS
Sunrise				
Husky says that the Sunrise project will not reach full capacity until 2017, due to the shut-down of operations during the Fort McMurray wildfires.				
Phase 1A	30,000	2015	Operating	SAGD
Phase 1B	30,000	2015	Operating	SAGD
Phase 2A	35,000	TBD	On Hold	SAGD
Phase 2B	35,000	TBD	Approved	SAGD
Future Phases	70,000	TBD	Approved	SAGD
Imperial Oil				
Aspen				
Alberta's environmental impact director says Imperial's environmental impact assessment report for the Aspen project has been deemed complete. Imperial has said that a final invest ment decision could be made as early as 2017.				
Phase 1	75,000	2020	Application	SA-SAGD
Phase 2	75,000	TBD	Application	SA-SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Ivanhoe Energy				
Tamarack				
Project is cancelled. Suncor has purchased the leases associated with Ivanhoe. FluidOil, a London-based company, has purchased the HTL technology and the San Antonio, Texas, testing facility.				
Phase 1	20,000	TBD	Cancelled	SAGD
Phase 2	20,000	TBD	Cancelled	SAGD
Koch Exploration Canada				
Dunkirk				
Koch has withdrawn the Dunkirk project from the regulatory review process.				
Commercial Demonstration	2,000	2017	Cancelled	SAGD
Phase 1	30,000	2018	Cancelled	SAGD
Phase 2	30,000	TBD	Cancelled	SAGD
Marathon Oil				
Birchwood				
This application has been closed by the AER.				
Demonstration	12,000	TBD	Cancelled	SAGD
Oak Point Energy				
Lewis				
Oak Point Energy says the Lewis project is well positioned (no additional work required) for exploitation when oil prices recover.				
Pilot	1,720	TBD	Approved	SAGD
Prosper Petroleum				
Rigel				
An objection was filed with this project in April 2015, and confidential documents were filed in April 2016.				
Phase 1	10,000	2017	Application	SAGD
Southern Pacific Resource				
STP-McKay				
Southern Pacific and certain of its subsidiaries have obtained creditor protection under the CCAA. The STP-McKay is being suspended to preserve capital until oil prices recover.				
Phase 1	12,000	2012	Suspended	SAGD
Suncor Energy				
Dover				
NSolv says that since start-up in Q2 2015, the pilot plant has produced over 60,000 barrels of oil. Suncor and NSolv have agreed to continue to test the solvent technology.				
NSolv BEST Pilot	300	2014	Operating	SAGD
ESEIEH Pilot	TBD	TBD	Operating	SAGD
Firebag				
Suncor says that work at Firebag continues to focus on well pad construction to sustain existing production and has deferred planned maintenance from 2016 to 2017. Effective Jan. 1, 2016, Suncor says nameplate capacity at Firebag increased from 180,000 to 203,000 bbls/d as a result of completion of debottlenecking activities.				
Stage 1	35,000	2004	Operating	SAGD
Stage 2	35,000	2006	Operating	SAGD
Cogeneration and Expansion	25,000	2007	Operating	SAGD
Stage 3	42,500	2011	Operating	SAGD
Stage 4	42,500	2012	Operating	SAGD
Stage 5	62,500	TBD	Approved	SAGD
Stage 6	62,500	TBD	Approved	SAGD
Stage 3-6 Debottleneck	23,000	2015	Operating	SAGD
Lewis				
Phase 1	40,000	TBD	Announced	In Situ
Phase 2	40,000	TBD	Announced	In Situ
MacKay River				
Suncor says that spending is currently focused on ongoing well pad construction to maintain existing production levels.				
Phase 1	33,000	2002	Operating	SAGD
Debottleneck	5,000	2014	Operating	SAGD
MR2	20,000	TBD	On Hold	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Sunshine Oilsands				
Legend Lake				
Regulatory approval is expected in 2016. Once the Legend Lake project is sanctioned for development and construction, additional financing will need to be secured to proceed.				
Phase A1	10,000	TBD	Application	SAGD
Phase A2	30,000	TBD	Announced	SAGD
Phase B1	30,000	TBD	Announced	SAGD
Phase B2	30,000	TBD	Announced	SAGD
Thickwood				
Once the Thickwood project is sanctioned for development and construction, additional financing will need to be secured to proceed.				
Phase A1	10,000	TBD	Approved	SAGD
Phase A2	30,000	TBD	Announced	SAGD
Phase B	30,000	2021	Announced	SAGD
West Ells				
Currently Sunshine has all Phase 1 well pairs on steam injection, with five well pairs converted to production mode. The remaining well pairs are expected to be converted to production by the end of August.				
Phase A1	5,000	2015	Operating	SAGD
Phase A2	5,000	TBD	Approved	SAGD
Phase A3	30,000	TBD	Announced	SAGD
Phase B	20,000	TBD	Announced	SAGD
Phase C1	30,000	TBD	Announced	SAGD
Phase C2	30,000	TBD	Announced	SAGD
Value Creation				
Audet				
Value Creation has acquired SilverWillow Energy and its Audet project.				
Pilot	12,000	TBD	Application	SAGD
SOUTH ATHABASCA REGION — IN SITU				
Athabasca Oil				
Hangingstone				
Hangingstone 1 is now 10 months into its production ramp up with 23 well pairs converted to SAGD production. Volumes for the quarter were partially impacted by operations maintenance. The environmental impact assessment director has deemed the EIA report complete for the Hangingstone expansion project. Athabasca Oil is required to resolve SOCs on the application and is expecting approval by the end of 2016.				
HS-1	12,000	2015	Operating	SAGD
HS-2A Debottleneck (1 and 2)	8,000	TBD	Application	SAGD
HS-2B Expansion	32,000	2019	Application	SAGD
HS-3	30,000	2021	Application	SAGD
BlackPearl Resources				
Blackrod				
BlackPearl has received approval from the AER. BlackPearl may seek a joint venture arrangement to accelerate development or may develop the project in smaller stages similar to its Onion Lake heavy oil project.				
Pilot	800	2011	Operating	SAGD
Phase 1	20,000	TBD	Approved	SAGD
Phase 2	30,000	TBD	Approved	SAGD
Phase 3	30,000	TBD	Approved	SAGD
Canadian Natural Resources				
Gregoire Lake				
Phase 1	60,000	TBD	Announced	SAGD
Phase 2	60,000	TBD	Announced	SAGD
Grouse				
The AER is waiting for Canadian Natural to resolve outstanding statements of concern filed on the application. The AER has completed its technical review of the application.				
Commercial	40,000	2020	Application	SAGD
Kirby				
Canadian Natural says that production at Kirby South continues to ramp up to design capacity. Q4 2015 volumes averaged 33,000 bbls/d, and in November, production exceeded 41,000 bbls/d.				
KS1 - Kirby South	40,000	2013	Operating	SAGD
KN1 - Kirby North	40,000	TBD	On Hold	SAGD
KN2 - Kirby North	60,000	TBD	Approved	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Cavalier Energy				
Hoole				
Regulatory approval for the first phase of the Hoole project was granted in June 2014. Development of this phase is dependent upon Cavalier Energy securing financing and sanctioning by its board of directors.				
Phase 1	10,000	TBD	Approved	SAGD
Phase 2A	35,000	TBD	Announced	SAGD
Phase 2B	35,000	TBD	Announced	SAGD
Cenovus Energy				
Christina Lake				
Cenovus is looking into building a diluent recovery unit at its Bruderheim crude-by-rail terminal. The Phase F expansion is nearing completion, with first oil expected in Q3 2016. Phase H received regulatory approval in December 2015.				
Phase 1A	10,000	2002	Operating	SAGD
Phase 1B	8,800	2008	Operating	SAGD
Phase C	40,000	2011	Operating	SAGD
Phase D	40,000	2012	Operating	SAGD
Phase E	40,000	2013	Operating	SAGD
Optimization (Phases C,D,E)	22,000	2015	Operating	SAGD
Phase F	50,000	2016	Construction	SAGD
Phase G	50,000	TBD	On Hold	SAGD
Phase H	50,000	TBD	Approved	SAGD
Foster Creek				
Cenovus says the majority of facilities for Foster Creek Phase G have been commissioned, and it is now producing oil. It is on track to be completed and add incremental barrels in Q3 and ramp up over an 18-month period.				
Phase A	24,000	2001	Operating	SAGD
Phase B Debottleneck	6,000	2003	Operating	SAGD
Phase C Stage 1	10,000	2005	Operating	SAGD
Phase C Stage 2	20,000	2007	Operating	SAGD
Phase D	30,000	2009	Operating	SAGD
Phase E	30,000	2009	Operating	SAGD
Phase F	30,000	2014	Operating	SAGD
Phase G	30,000	2016	Operating	SAGD
Phase H	30,000	2017	On Hold	SAGD
Future Optimization (Phases F,G,H)	35,000	TBD	Announced	SAGD
Phase J	50,000	TBD	Approved	SAGD
Future Optimization	15,000	TBD	Announced	SAGD
Grand Rapids				
Cenovus has suspended operations at the Grand Rapids pilot due to low market conditions.				
Pelican Lake Pilot	600	2011	Suspended	SAGD
Pelican Upper Grand Rapids Phase A	10,000	TBD	On Hold	SAP-SAGD
Pelican Upper Grand Rapids Phase B	32,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase C	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase D	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase E	32,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase F	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase G	19,000	TBD	Approved	SAP-SAGD
Narrows Lake				
Plans for 2016 include detailed engineering for Phase A.				
Phase A	45,000	TBD	On Hold	SAP-SAGD
Phase B	45,000	TBD	Approved	SAP-SAGD
Phase C	40,000	TBD	Approved	SAP-SAGD
West Kirby				
Phase 1	30,000	TBD	Announced	SAGD
Winefred Lake				
Phase 1	30,000	TBD	Announced	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
CNOOC				
Long Lake				
CNOOC subsidiary Nexen made an announcement regarding the pipeline rupture and HCU explosion. The pipeline rupture was a result of incompatible pipeline design for ground conditions. Upon investigation, Nexen found that a short-term repair of the HCU is not feasible. Nexen will begin to move the Long Lake upgrader into winter preservation (cold stack) mode. A planned date to return the upgrader to service has not been established. A SAGD only operation has led to a staff reduction of 350 employees by the end of 2016.				
Phase 1	72,000	2008	Operating	SAGD
Kinosis (K1A)	20,000	2014	Operating	SAGD
Kinosis (K1B)	37,500	TBD	Approved	SAGD
Connacher Oil and Gas				
Great Divide				
Connacher is reducing production at the Great Divide project to between 7,000 and 8,000 bbls/d in light of "exceptionally low commodity prices." Connacher has filed for CCAA protection and has received permission to sell leases and plants.				
Pod One	10,000	2007	Operating	SAGD
Algar	10,000	2010	Operating	SAGD
Expansion 1A	12,000	TBD	Approved	SAGD
Expansion 1B	12,000	TBD	Approved	SAGD
ConocoPhillips Canada				
Surmont				
ConocoPhillips says that production at Surmont 2 is expected to ramp up through 2017. The Surmont 3 project application and EIA were submitted in 2015. ConocoPhillips submitted responses to the second round of SIR on March 16, 2016.				
Pilot	1,200	1997	Operating	SAGD
Phase 1	30,000	2007	Operating	SAGD
Phase 2	118,000	2015	Operating	SAGD
Phase 2 Debottleneck	57,000	TBD	Approved	SAGD
Phase 3 - Tranche 1	45,000	2020	Application	SAGD
Phase 3 - Tranche 2	45,000	2021	Application	SAGD
Phase 3 - Tranche 3	45,000	2023	Application	SAGD
Devon Canada				
Jackfish				
Gross production at Jackfish 3 exceeded nameplate capacity, averaging 38,100 bbls/d in Q4.				
Phase 1	35,000	2007	Operating	SAGD
Phase 2	35,000	2011	Operating	SAGD
Phase 3	35,000	2014	Operating	SAGD
Jackfish East				
Expansion	20,000	2018	Announced	SAGD
Pike				
Devon has applied to amend total capacity of the Pike project to 70,000 bbls/d from 105,000 bbls/d using 52 well pads and 12 once-through steam generators. FEED is expected to be completed in 2015 as well as a cost structure.				
1A	35,000	2019	Approved	SAGD
1B	35,000	2020	Approved	SAGD
1C	35,000	TBD	Cancelled	SAGD
Grizzly Oil Sands				
Algar Lake				
Grizzly has suspended operations at Algar due to low commodity prices.				
Phase 1	6,000	2014	Suspended	SAGD
Phase 2	6,000	TBD	Approved	SAGD
May River				
Regulatory approval is expected in 2016.				
Phase 1	6,000	TBD	Application	SAGD
Phase 2	6,000	TBD	Application	SAGD
Harvest Operations				
BlackGold				
Harvest says the CPF is complete, and minor pre-commissioning activities were completed during 2015. Decision to complete commissioning and commence steam injection depends on a number of factors including the bitumen price environment. According to Harvest, it will cost $57 million to $67 million to start production under the current price environment.				
Phase 1	10,000	TBD	On Hold	SAGD
Phase 2	20,000	TBD	Approved	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Japan Canada Oil Sands				
Hangingstone				
Production of the expansion project is expected in 2017. JACOS is moving employees to the expansion site from the pilot project, which has been shut in due to a low oil price environment.				
Expansion	20,000	2016	Construction	SAGD
Hangingstone Pilot				
Japan Petroleum Exploration will not restart production at its Hangingstone oil sands pilot project due to low oil prices. The plant was shut down in early May in response to the Fort McMurray wild fires. The pilot project has applied to the AER to inject methane to retain reservoir pressures until Q1 2017 when start-up activities could begin. The company will move staff to the expansion project, where production is expected to start in 2017.				
Pilot	11,000	1999	Suspended	SAGD
Koch Exploration Canada				
Muskwa				
Regulatory approval was granted in June 2014.				
Pilot	10,000	TBD	Approved	SAGD
Laricina Energy				
Germain				
During Q1 2015, Laricina suspended operations at the Germain CDP.				
Phase 1 CDP	5,000	2013	Suspended	SC-SAGD
Phase 2	30,000	TBD	On Hold	SC-SAGD
Phase 3	60,000	TBD	On Hold	SC-SAGD
Phase 4	60,000	TBD	On Hold	SC-SAGD
Saleski				
Laricina reached approximately 80 per cent completion of detailed engineering and design for Saleski Phase 1 before the decision to defer further development of the project was made in Q1 2015.				
Experimental Pilot	1,800	2011	Suspended	C & SC-SAGD
Phase 1	10,700	TBD	On Hold	C-SAGD
Phase 2	30,000	TBD	On Hold	In situ
Phase 3	60,000	TBD	Announced	In situ
Phase 4	60,000	2023	Announced	In situ
Phase 5	60,000	2026	Announced	In situ
Phase 6	60,000	TBD	Announced	In situ
MEG Energy				
Christina Lake				
MEG temporarily suspended operations March 3-4 due to a small fire in the plant's sulphur treatment facility. The company says the fire did not impact the integrity of the main processing facilities and resulted in no injuries. MEG has reduced its 2016 budget by 50 per cent to $170 million.				
Phase 1 Pilot	3,000	2008	Operating	SAGD
Phase 2A	22,000	2009	Operating	SAGD
Phase 2B	35,000	2013	Operating	SAGD
Phase 3A	50,000	TBD	Approved	SAGD
Phase 3B	50,000	TBD	Approved	SAGD
Phase 3C	50,000	TBD	Approved	SAGD
May River				
The Alberta director of environmental assessment has issued the final terms of reference for MEG's May River project. The next step is to file the joint EIA and regulatory application. MEG expects to start construction in Q4 2019, pending regulatory approval.				
Phase 1	41,000	TBD	Announced	SAGD
Phase 2	41,000	TBD	Announced	SAGD
Phase 3	82,000	TBD	Announced	SAGD
Surmont				
The environmental assessment director has deemed the EIA report complete for MEG Energy's Surmont Project.				
Phase 1	40,000	TBD	Application	SAGD
Phase 2	40,000	TBD	Application	SAGD
Phase 3	40,000	TBD	Application	SAGD
OSUM Oil Sands				
Sepiko Kesik				
The AER is waiting for confirmation from the Aboriginal Consultation Office regarding First Nations consultation adequacy. The AER has completed its technical review of the application.				
Phase 1	30,000	2018	Application	CSS-SAGD
Phase 2	30,000	2020	Application	CSS-SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
PTT Exploration and Production				
Mariana - Thornbury				
PTTEP has postponed key development projects such as the Mariana Oil Sands Project. PTTEP responded to the second round of SIR requests on April 19, 2016.				
Phase 1	20,000	2021	Application	SAGD
Renergy Petroleum (Canada)				
Muskwa				
Renergy Petroleum received regulatory approval in January 2015.				
Muskwa Expenmental Pilot	440	2015	Approved	Steam & CO_2
Statoil				
Leismer				
Demonstration	10,000	2010	Operating	SAGD
Commercial	10,000	2011	Operating	SAGD
Expansion	20,000	TBD	Approved	SAGD
Northwest	20,000	TBD	Disclosed	SAGD
Suncor Energy				
Chard				
Phase 1	40,000	TBD	Announced	SAGD
Meadow Creek East				
Jacobs Engineering has been awarded the design basis memorandum contract for the Meadow Creek project using a replication strategy.				
Phase 1	40,000	2020	Approved	SAGD
Phase 2	40,000	2022	Approved	SAGD
Surmont Energy				
Wildwood				
Surmont has received approval for the project from the AER.				
Phase 1	12,000	TBD	Approved	SAGD
Value Creation				
Advanced TriStar				
Alberta Environmental Assessment Agency has deemed the EIA report complete for the ATS project. The review took 165 weeks.				
ATS-1	30,000	TBD	Application	SAGD
ATS-2	30,000	TBD	Application	SAGD
DOEx (Demonstration of ExcelDence)				
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	6,000	2018	Application	SAGD
COLD LAKE REGION — IN SITU				
Baytex Energy				
Gemini				
Baytex has made the decision to decommission the Gemini SAGD pilot due to low oil pricing. The company says that, since operations started last year, the pilot has successfully captured the key data associated with its objectives. The company's primary objective was to confirm reservoir production capacity to support a commercial-scale project. Following regulatory approval for the commercial project, any subsequent sanctioning decision will be considered in the context of the project economics in a higher commodity price environment.				
Pilot	1,200	2014	Suspended	SAGD
Commercial	5,000	TBD	Approved	SAGD
Birchwood Resources				
Sage				
This application has been withdrawn.				
Pilot	5,000	TBD	Cancelled	LP-SAGD
Canadian Natural Resources				
Primrose & Wolf Lake				
Canadian Natural says that it continues to progress low-pressure steamflood operations at Primrose East Area 1 and low-pressure CSS operations at Primrose East Area 2. Operations at Primrose East are meeting expectations.				
Wolf Lake	13,000	1985	Operating	CSS
Primrose South	45,000	1985	Operating	CSS
Primrose North	30,000	2006	Operating	CSS
Primrose East	32,000	2008	Operating	CSS
Devon Canada				
Walleye				
Devon says the Walleye project is currently on hold.				
Phase 1	9,000	TBD	Approved	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Husky Energy				
Caribou				
Demonstration	10,000	TBD	Approved	SAGD
Tucker				
Husky says that work is continuing to increase production and improve returns, with a new well pad that will add 5,000 bbls/d to bring production up to 20,000 bbls/d in 2017. Overall production at Tucker has averaged about 15,000 bbls/d since the beginning of September 2015.				
Phase 1	30,000	2006	Operating	SAGD
Imperial Oil				
Cold Lake				
Looking ahead, Cold Lake, including Nabiye, will manage steaming strategies across all assets to enhance resource recovery. Late in 2015, Alberta Environment and Parks issued the final terms of reference for the Cold Lake Expansion project, the regulatory application was filed March 11. In June, Imperial filed an application to terminate the SA-SAGD pilot project and integrate the pilot into the Cold Lake project based on successful results.				
Phase 1-10	110,000	1985	Operating	CSS
Phase 11-13	30,000	2002	Operating	CSS
Experimental SA-SAGD	TBD	2010	Operating	SA-SAGD
Phase 14-16	40,000	2015	Operating	CSS
Expansion	55,000	TBD	Application	SA-SAGD
OSUM Oil Sands				
Orion				
OSUM plans to revise the approved well pad development sequence at Orion, deferring two originally planned pads and developing on new sustaining pad as well as three new pads to increase production to the approved 20,000 bbls/d.				
Phase 1	10,000	2007	Operating	SAGD
Phase 2	10,000	TBD	Approved	SAGD
Taiga				
OSUM says that Taiga Phase 1 will be advanced in 2015-16 subject to financing.				
Phase 1	12,500	TBD	Approved	CSS-SAGD
Phase 2	12,500	TBD	Approved	CSS-SAGD
Phase 3	20,000	TBD	Approved	CSS-SAGD
Pengrowth Energy				
Lindbergh				
The AER has approved the Lindbergh expansion project, with a thermal well compatibility condition prior to drilling start. The 2016 allocation of $14 million of capital to Lindbergh will be directed to maintenance activities as well as further pre-engineering and design for the Phase 2 expansion. Final investment decision will be based in part on commodity prices. Pengrowth has applied to the AER to drill infill wells on Phase 1.				
Pilot	1,260	2012	Operating	SAGD
Phase 1	11,240	2015	Operating	SAGD
Phase 1 Optimization	3,500	TBD	Operating	SAGD
Phase 2 Expansion	17,500	TBD	On Hold	SAGD
PEACE RIVER REGION — IN SITU				
Andora Energy				
Sawn Lake				
Project partner Pan Orient Energy says that the demonstration project was suspended at the end of February 2016 due to the expectation that extremely low bitumen prices may continue for some time, as well as the estimated time required for regulatory approval of the 3,200-bbl/d expansion application, which was submitted in April 2016. It is expected that a reactivation of the demonstration project would be considered as part of the expansion.				
Demonstration	1,400	2014	Suspended	SAGD
Expansion	3,200	2019	Application	SAGD
Baytex Energy				
Cliffdale				
Baytex says that operations at the Cliffdale CSS pilot were suspended in late September 2015.				
Pilot	2,000	2011	Suspended	CSS
Dawson				
Touchstone Exploration has disposed of its interest in the Dawson area of Alberta for cash consideration of $2.15 million				
Experimental Demonstration	TBD	2014	Suspended	CSS
Harmon Valley				
Pilot	TBD	2011	Operating	CSS

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Murphy Oil Company				
Seal/Cadotte				
The AER has sent another SIR request on April 19, 2016. A response is required by May 10, 2016. Oil production for 2016 in western Canada, excluding Syncrude, is expected to average 3,600 bbls/d. The decrease in oil production in 2016 arises from well declines and selective economic-related well shut-ins in the Seal area due to lower heavy oil prices.				
Pilot	TBD	TBD	Operating	HCSS
Demonstration	12,450	2019	Application	HCSS
Northern Alberta Oil				
Sawn Lake				
Parent company Deep Well Oil & Gas says it is waiting on the preliminary results of the Sawn Lake SAGD pilot operated by Andora Energy to fine-tune the horizontal cyclic steam project design. Deep Well is a partner in the Sawn Lake project.				
Pilot	700	TBD	Approved	HCSS
Penn West Petroleum				
Harmon Valley South				
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner, allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by its partner in the PROP joint venture.				
Pilot	TBD	2014	Operating	HCSS
Seal Main				
The AER is waiting for Penn West to resolve outstanding statements of concern filed on the application. The AER has completed its technical review of the application.				
Pilot	75	2011	Operating	HCSS
Commercial	10,000	TBD	Application	HCSS
Royal Dutch Shell				
Peace River				
Shell has stopped construction of the Carmon Creek project. Shell is retaining the project leases and some equipment as evaluations are ongoing.				
Cadotte Lake	12,500	1986	Operating	CSS
Carmon Creek - Phase 1	40,000	TBD	On Hold	VSD
Carmon Creek - Phase 2	40,000	TBD	On Hold	VSD
SCCC Petroleum				
Red Earth				
SCCC Petroleum received regulatory approval for the pilot phase in July 2015.				
Pilot	440	2009	Approved	Steam & CO_2
NORTH ATHABASCA REGION — UPGRADER				
BP				
Terre de Grace				
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2020.				
Pilot	8,400	TBD	Approved	ADC USP
Canadian Natural Resources				
Horizon				
Horizon Phase 2B started up in October 2016 and will add 45,000 bbls/d of production. Phase 3 is currently 83 per cent complete and is on schedule and budget with start-up in Q4 2017.				
Phase 1	110,000	2009	Operating	UPG
Reliability - Tranche 2	5,000	2014	Operating	UPG
Phase 2A	12,000	2014	Operating	UPG
Phase 2B	45,000	2016	Operating	UPG
Phase 3	80,000	2017	Construction	UPG
E-T Energy				
Poplar Creek				
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	TBD	TBD	Announced	CCC
Ivanhoe Energy				
Tamarack				
Project is cancelled. Suncor has purchased the leases associated with Ivanhoe. FluidOil, a London-based company, has purchased the HTL technology and the San Antonio, Texas, testing facility.				
Phase 1	34,784	TBD	Cancelled	HTL

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Suncor Energy				
Base Operations				
Suncor says that planned upgrader maintenance was completed in Q4 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
U1 and U2	225,000	1967	Operating	UPG
Millennium Vacuum Unit	35,000	2005	Operating	UPG
Millennium Coker Unit	97,000	2008	Operating	UPG
Syncrude Canada				
Mildred Lake/Aurora				
In December 2015, Syncrude performed coker maintenance originally scheduled for mid-2016. Suncor has closed the purchasing of Murphy Oil's five per cent stake in Syncrude and now owns 53.74 per cent of Syncrude. On Feb. 12, 2016, the company submitted supplemental information to the AER for the mine extension project, which is under review.				
Base Plant Stage 1 & 2 Debottleneck	250,000	1978	Operating	UPG
Stage 3 Expansion (UE-1)	100,000	2006	Operating	UPG
Stage 3 Debottleneck	75,000	TBD	Announced	UPG
SOUTH ATHABASCA REGION — UPGRADER				
CNOOC				
Long Lake				
CNOOC subsidiary Nexen made an announcement regarding the pipeline rupture and HCU explosion. The pipeline rupture was a result of incompatible pipeline design for ground conditions. Upon investigation, Nexen found that a short-term repair of the HCU is not feasible. Nexen will begin to move the Long Lake upgrader into winter preservation (cold stack) mode. A planned date to return the upgrader to service has not been established. A SAGD only operation has led to a staff reduction of 350 employees by the end of 2016.				
Phase 1	58,500	2009	Suspended	OrCrude
Value Creation				
Advanced TriStar				
Alberta Environmental Assessment Agency has deemed the EIA report complete for the ATS project. The review took 165 weeks.				
ATS-1	60,000	TBD	Application	ATS USP
ATS-2	60,000	TBD	Application	ATS USP
DOEx (Demonstration of Excellence)				
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	12,000	2018	Application	ATS USP
INDUSTRIAL HEARTLAND REGION — UPGRADER				
North West Upgrading				
Redwater Upgrader				
As the result of an on-site pedestrian vehicle incident Dec. 9, 2015, one of NWR's employees was fatally injured. The on-site workforce has reached 3,800 people. To date, approximately 400 modules have been installed with more than 600 additional modules standing in various stages of assembly at module fabrication shops. Module delivery and assembly into the refinery will continue throughout 2016. Targeted completion in Q4 2017.				
Phase 1	50,000	2017	Construction	UPG
Phase 2	50,000	TBD	Approved	UPG
Phase 3	50,000	TBD	Approved	UPG
Shell Albian Sands				
Scotford Upgrader				
Shell has made a final investment decision on the HCU debottleneck project, which is expected to increase hydrocracking capacity by about 20 per cent. Project partner Marathon Oil says that planned turnarounds at the base upgrader and Muskeg River mine were completed on time and on budget in Q2, as well as unplanned downtime at the expansion upgrader.				
Commercial	155,000	2003	Operating	UPG
Expansion	100,000	2011	Operating	UPG
Scotford HCU Debottleneck	14,000	TBD	Announced	UPG
Value Creation				
Heartland				
Value Creation has an amendment application for the Heartland upgrader project changing the project from three phases to two and reducing total production to 173,600 bbls/d. The company will be using DRU, ADC, COC and CORe technologies to process the diluted bitumen feedstock.				
Phase 1A	43,400	2019	Application	UPG
Phase 1B	43,400	2021	Application	UPG
Phase 2	86,800	TBD	Application	UPG

GLOSSARY of oil sands terms

ASPHALTENES
The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

BARREL
The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

BITUMEN
Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

COGENERATION
The simultaneous production of electricity and steam, which is part of the operations of many oil sands projects.

COKING
An upgrading/refining process used to convert the heaviest fraction of bitumen into lighter hydrocarbons by rejecting carbon as coke. Coking can be either delayed coking (semi-batch) or fluid coking (continuous).

CONDENSATE
Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

CONVENTIONAL CRUDE OIL
Mixture of mainly pentane and heavier hydrocarbons recoverable at a well from an underground reservoir, and liquid at atmospheric pressure and temperature. Unlike bitumen, it flows through a well without stimulation and through a pipeline without processing or dilution.

CRACKING
An upgrading/refining process for converting large, heavy molecules into smaller ones. Cracking processes include fluid cracking and hydrocracking.

CYCLIC STEAM STIMULATION (CSS)
An in situ production method incorporating cycles of steam injection, steam soaking and oil production. The steam reduces the viscosity of the bitumen and allows it to flow to the production well.

DENSITY
The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to 900 kg/m^3 is considered light-to-medium crude—oil above this density is deemed as heavy oil or bitumen.

DILBIT
Bitumen that has been reduced in viscosity through addition of a diluent such as condensate or naphtha.

DILUENT
A light hydrocarbon blended with bitumen to enable pipeline transport. See Condensate.

EXTRACTION
A process, unique to the oil sands industry, that separates the bitumen from the oil sand using hot water, steam and caustic soda.

FROTH TREATMENT
The means to recover bitumen from the mixture of water, bitumen and solids "froth" produced in hot-water extraction (in mining-based recovery).

GASIFICATION
A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy by-products.

GROUNDWATER
Water accumulations below the Earth's surface that supply fresh water to wells and springs.

HEAVY CRUDE OIL
Oil with a gravity below 22 degrees API. Heavy crudes must be blended or mixed with condensate to be shipped by pipeline.

HYDROCRACKING
Refining process for reducing heavy hydrocarbons into lighter fractions, using hydrogen and a catalyst; can also be used in upgrading bitumen.

HYDROTRANSPORT
A slurry process that transports water and oil sand through a pipeline to primary separation vessels located in an extraction plant.

HYDROTREATER
An upgrading/refining process unit that reduces sulphur and nitrogen levels in crude oil fractions by catalytic addition of hydrogen.

IN SITU
A Latin phrase meaning "in its original place." In situ recovery refers to various drilling-based methods used to recover deeply buried bitumen deposits.

IN SITU COMBUSTION
An enhanced oil recovery method that works by generating combustion gases (primarily CO and CO_2) downhole, which then "push" the oil towards the recovery well.

LEASE
A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

LIGHT CRUDE OIL
Liquid petroleum with a gravity of 28 degrees API or higher. A high-quality light crude oil might have a gravity of about 40 degrees API. Upgraded crude oils from the oil sands run around 30-33 degrees API (compared to 32-34 for Light Arab and 37-40 for West Texas Intermediate).

MATURE FINE TAILINGS
A gel-like material resulting from the processing of clay fines contained within the oil sands.

OIL SANDS
Bitumen-soaked sand deposits located in three geographic regions of Alberta: Athabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total in-place deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

OVERBURDEN
A layer of sand, gravel and shale between the surface and the underlying oil sand in the mineable oil sands region that must be removed before oil sands can be mined.

PERMEABILITY
The capacity of a substance (such as rock) to transmit a fluid, such as crude oil, natural gas or water. The degree of permeability depends on the number, size and shape of the pores and/or fractures in the rock and their interconnections. It is measured by the time it takes a fluid of standard viscosity to move a given distance. The unit of permeability is the Darcy.

PETROLEUM COKE
Solid, black hydrocarbon that is left as a residue after the more valuable hydrocarbons have been removed from the bitumen by heating the bitumen to high temperatures.

PRIMARY PRODUCTION
An in situ recovery method that uses natural reservoir energy (such as gas drive, water drive and gravity drainage) to displace hydrocarbons from the reservoir into the wellbore and up to the surface. Primary production uses an artificial lift system in order to reduce the bottomhole pressure or increase the differential pressure to sustain hydrocarbon recovery, since reservoir pressure decreases with production.

RECLAMATION
Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

STEAM ASSISTED GRAVITY DRAINAGE (SAGD)
An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

SURFACE MINING
Operations to recover oil sands by open-pit mining using trucks and shovels. Less than 20 per cent of Alberta's oil sands resources are located close enough to the surface (within 75 metres) for mining to be economic.

SYNTHETIC CRUDE OIL
A manufactured crude oil comprised of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

TAILINGS
A combination of water, sand, silt and fine clay particles that is a by-product of removing the bitumen from the oil sand through the extraction process.

TAILINGS SETTLING BASIN
The primary purpose of the tailings settling basin is to serve as a process vessel, allowing time for tailings water to clarify and silt and clay particles to settle so that the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

THERMAL RECOVERY
Any in situ process where heat energy (generally steam) is used to reduce the viscosity of bitumen to facilitate recovery.

UPGRADING
The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

VISCOSITY
The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.

OIL SANDS CONTACTS

OIL SANDS PRODUCERS

Athabasca Oil www.athia.com
Baytex Energy www.baytex.ab.ca
BlackPearl Resources www.blackpearlresources.ca
Brion Energy www.brionenergy.com
Canadian Natural Resources www.cnrl.com
Cenovus Energy www.cenovus.com
Chevron Canada www.chevron.ca
CNOOC www.cnoocltd.com
Connacher Oil and Gas www.connacheroil.com
ConocoPhillips Canada www.conocophillips.ca
Devon Canada www.dvn.com
Enerplus Resources Fund www.enerplus.com
E-T Energy www.e-tenergy.com
Grizzly Oil Sands www.grizzlyoilsands.com
Harvest Operations www.harvestenergy.ca
Husky Energy www.huskyenergy.ca
Imperial Oil www.imperialoil.ca
Japan Canada Oil Sands www.jacos.com
Koch Exploration Canada www.kochexploration.ca
Korea National Oil www.knoc.co.kr
Laricina Energy www.laricinaenergy.com
Marathon Oil www.marathon.com
MEG Energy www.megenergy.com
Nexen www.nexeninc.com
North West Upgrading www.northwestupgrading.com
NSolv www.nsolv.ca
Oak Point Energy www.oakpointenergy.ca
Occidental Petroleum www.oxy.com
Osum Oil Sands www.osumcorp.com
Pan Orient Energy www.panorient.ca
Paramount Resources www.paramountres.com
Pengrowth Energy www.pengrowth.com
PetroChina www.petrochina.com.cn/ptr
PTT Exploration and Production www.pttep.com
Shell Canada www.shell.ca
Sinopec www.sinopecgroup.com/group/en
Statoil Canada www.statoil.com
Suncor Energy www.suncor.com
Sunshine Oilsands www.sunshineoilsands.com
Syncrude www.syncrude.ca
Teck Resources www.teck.com
Total E&P Canada www.total-ep-canada.com
Touchstone Exploration www.touchstoneexploration.com
Value Creation Group www.vctek.com

ASSOCIATIONS/ORGANIZATIONS

Alberta Chamber of Resources www.acr-alberta.com
Alberta Chambers of Commerce www.abchamber.ca
Alberta Energy www.energy.gov.ab.ca
Alberta Energy Regulator www.aer.ca
Alberta Environment and Parks www.aep.alberta.ca
Alberta Innovates www.albertainnovates.ca
Alberta Innovation and Advanced Education www.eae.alberta.ca
Alberta's Industrial Heartland Association
www.industrialheartland.com
Building Trades of Alberta www.bta.ca
Canada's Oil Sands Innovation Alliance www.cosia.ca
Canadian Association of Geophysical Contractors www.cagc.ca
Canadian Association of Petroleum Producers www.capp.ca
Canadian Heavy Oil Association www.choa.ab.ca
In Situ Oil Sands Alliance www.iosa.ca
Lakeland Industry & Community Association www.lica.ca
Natural Resources Conservation Board www.nrcb.ca
Oil Sands Community Alliance www.oscaalberta.ca
Oil Sands Secretariat www.energy.alberta.ca
Petroleum Technology Alliance Canada www.ptac.org